A NEW VALUE CHAIN FOR RUBBER AND INULIN PRODUCTION IN THE EUROPEAN BIOECONOMY

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ABSTRACT: ‘DRIVE4EU - Dandelion Rubber and Inulin Valorization and Exploitation for Europe’, a demonstration project, aims at the development of a value chain for natural rubber and inulin from Rubber dandelions. The objective of the project is to set up a new European chain for the production and processing of natural rubber. This will enable the EU to become less dependent on the import of natural rubber and at the same time to respond to the threat of a global rubber shortage. The viability of using Rubber dandelions for rubber and inulin production depends on the sustainability of this new value chain. The results of a general economic assessment shows that the total costs over the whole value chain are dominated by the costs for cultivation and harvesting and the cost for biorefining. The combination of natural rubber and inulin makes Rubber dandelion very interesting as a production platform.

Keywords: Biobased economy, biorefinery, rubber, novel crop

1 INTRODUCTION

Natural rubber is a sustainable material that is used for more than 40,000 products, among others natural rubber is applied in construction (sealants), medicine (gloves) and transportation (matting, tyres) industries. At the moment natural rubber is exclusively harvested from the rubber tree of which about 90% is grown in South East Asia. Because of the specific quality aspects of natural rubber in many products it cannot be replaced by synthetic rubber. DRIVE4EU - ‘Dandelion Rubber and Inulin Valorization and Exploitation for Europe’, a European demonstration project sets up a European chain for the production and processing of natural rubber and inulin from Taraxacum koksaaghyz (TKS, Russian or Rubber dandelion) to become less dependent on the import of natural rubber.

The main activities in DRIVE4EU are:

- breeding of plant genotypes with high root biomass, high rubber and inulin yield,
- amplification of seed batches for agronomic tests and large scale demo field trials,
- optimized cultivation (Figure 1) and harvest methods of Rubber dandelion,
- ecological analysis of the gene flow between TKS and wild dandelions,
- scaled-up and optimized extraction and refinery protocol for natural rubber and inulin,
- testing and application of natural rubber and inulin in end product uses, and
- demonstration of the economic viability of the new production chain for natural rubber and inulin.

2 PURPOSE OF THE WORK AND APPROACH

DRIVE4EU demonstrates the technical, economic and environmental feasibility of the use of Rubber dandelion as a production platform for natural rubber and inulin, the possible product portfolio is shown in Figure 2.

Figure 1: Cultivation of Rubber dandelion

The viability of using Rubber dandelion for rubber and inulin production depends on the sustainability (environmental, economic, social) of this new value chain. The life cycle sustainability assessment (LCSA) within DRIVE4EU includes economic and environmental aspects and provides information about the economic and environmental sustainability in comparison to a substituted reference system. The existing methodologies life cycle analysis (LCA) and life cycle costing (LCC) are modified for the new value chain for rubber and inulin production. Within each dimension of the sustainability different elements of sustainability effects are assessed based on scientific indicators.

Figure 2: Value chain with its possible product portfolio
3 SCIENTIFIC INNOVATION AND RELEVANCE

DRIVE4EU demonstrates a new value chain for European natural rubber and inulin production and enables the EU to become less dependent on the import of natural rubber and at the same time to respond to the threat of a global rubber shortage. Within the life cycle sustainability assessment (LCSA) scientific economic (e.g. operational costs, investment cost, trade effects, effects on employment) and environmental indicators (e.g. global warming potential, cumulated primary energy demand, land use) are used to guide the development of the DRIVE4EU value chain to realize the highest possible sustainability in comparison to a substituted reference system.

4 RESULTS

The economic analysis of rubber and inulin production from Rubber dandelion identifies the putative bottlenecks for the future commercialization. The general economic analysis was based on the consideration of two possible future business cases in “10 years” and “25 years” with rubber and inulin (for food, chemicals, biogas and bioethanol) as main products and co-products: feed and biogas from roots and leaves. The whole value chain from Rubber dandelion to rubber and inulin includes the following 7 main processes:

1. Rubber dandelion cultivation and harvesting;
2. Rubber dandelion transport;
3. Rubber dandelion (drying &) storage;
4. Biorefinery (including processing of inulin);
5. Feed production;
6. Biogas production and
7. Bioethanol production.

The total costs in the whole value chain are dominated by the cost for cultivation and harvesting (Figure 3) and the cost for biorefining, including processing of inulin. The other costs for transportation, storage, biogas and bioethanol production are relatively low. An environmental assessment (LCA) provides information about the impacts of several environmental impacts, e.g. GHG emissions, land use change in comparison to the conventional reference system.

![Figure 3: Costs of cultivation and harvesting](image)

5 CONCLUSIONS

DRIVE4EU demonstrates the technical and economic feasibility and the environmental sustainability of the use of Rubber dandelion as a production platform for both natural rubber and inulin. The inulin can be used as raw material for interesting green chemicals, such as furan-based polymers. The combination of natural rubber and inulin makes Rubber dandelion very interesting as a production platform. The project offers the EU a unique competitive advantage, because DRIVE4EU relies heavily on the industrial expertise in the fields of Rubber dandelion breeding and biorefinery of inulin containing root crops.

6 REFERENCES


7 ACKNOWLEDGEMENTS

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